

# **Development of a mirror energy analyzer of charged particles beams based on a modified electrostatic field**

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The work presents the results of numerical modeling of an electron-optical scheme of a **plane-symmetrical mirror energy analyzer based on a modified field.**

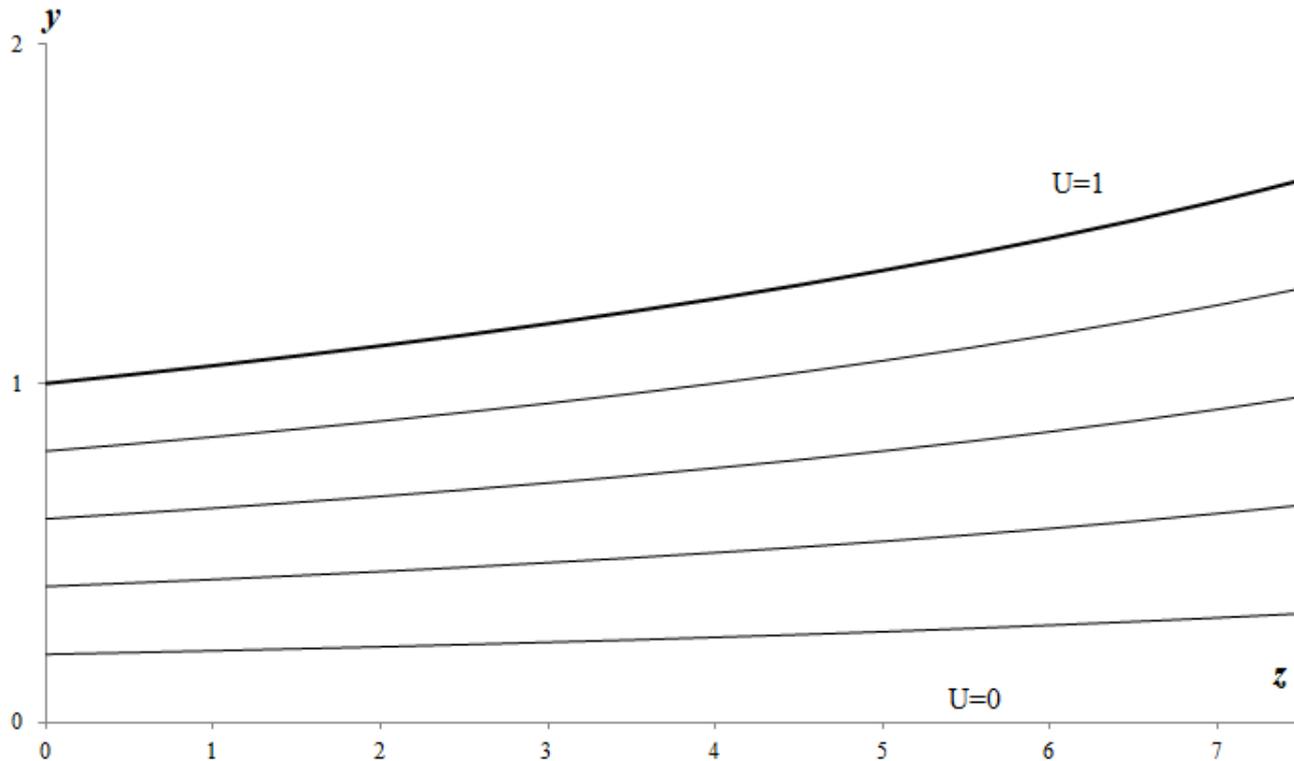
The calculation of the trajectories of charged particles in the analyzer field, necessary for analyzing the electron-optical characteristics of the proposed device, was performed on the basis of a numerical calculation method by using the **“Focus” program.**

The modified field is non-uniform, decreasing according to the hyperbolic law and is a superposition of a dipole with a uniform field. The potential of a modified field in coordinate system  $y, z$  is described by the following expression

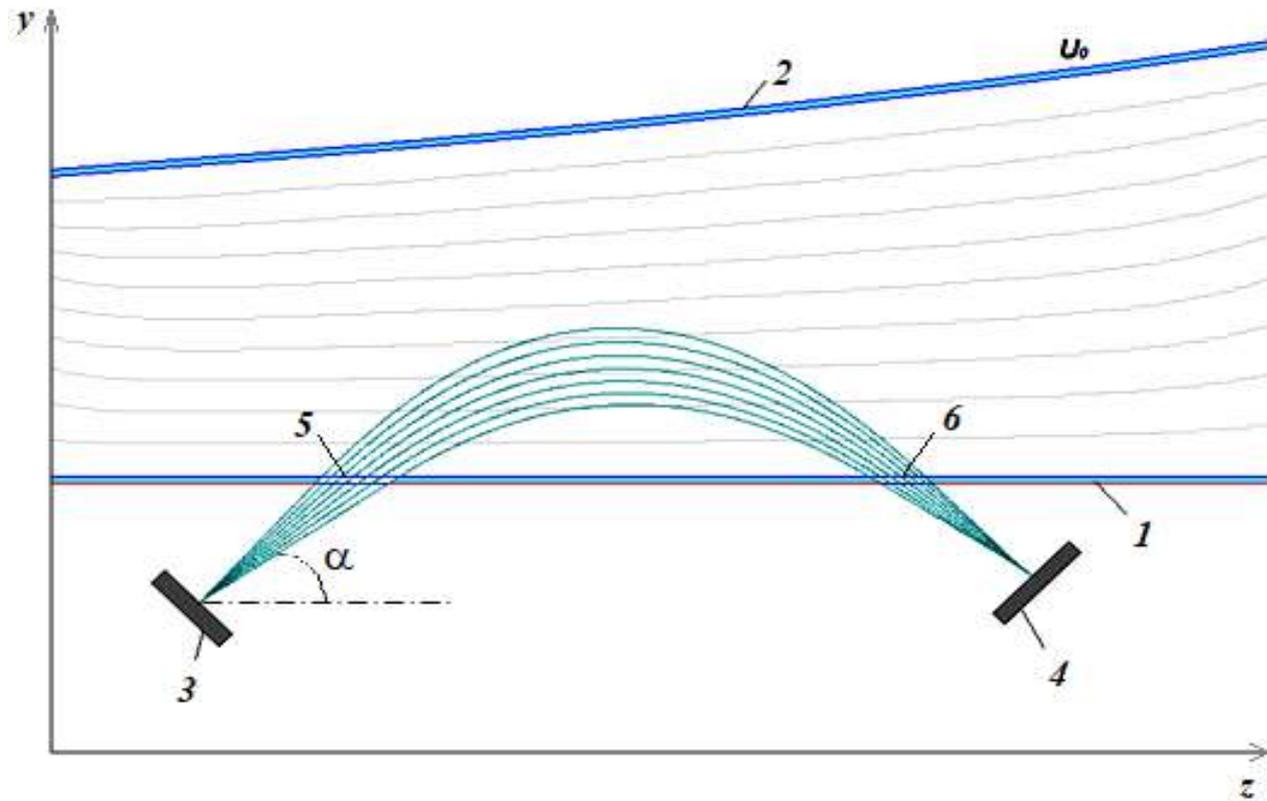
$$U = \frac{U_0}{d} y (1 - Az)$$

where  $A$  is the small dimensionless parameter, at  $A=0$  field (1) is uniform (case of a plane mirror),  $d$  is the distance between the two electrodes.

The profile of the outer deflecting electrode is determined from the calculation of equipotential lines in the non-uniform field.



**Equipotential lines in the electrostatic non-uniform field at a value of parameter  $A=0.05$ .**



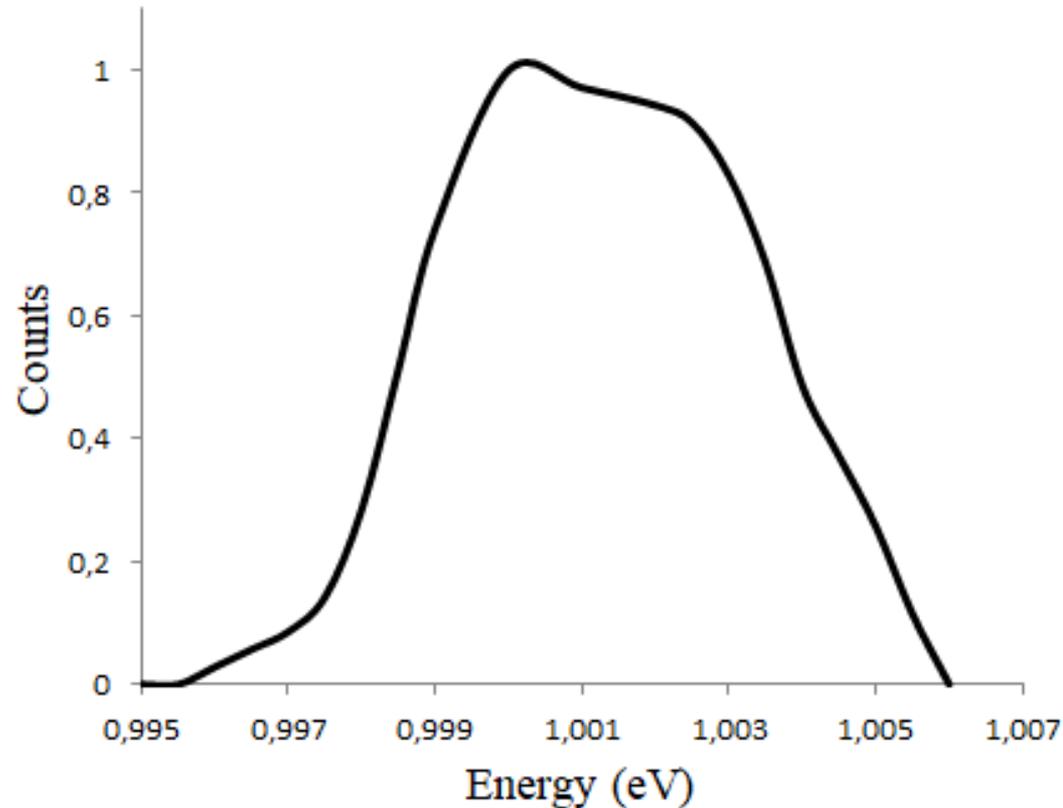
**The scheme of a longitudinal section of an energy analyzer based on a modified field at parameter  $A = 0.05$ :**

**1 is a lower plane plate, 2 is a deflecting electrode, 3 is an investigation sample with a point source; 4 is the detector, 5 is the entrance slit, 6 is exit slit.**

**TABLE 1.** THE FOCUSING PROPERTIES OF THE ENERGY ANALYZER BASED ON A MODIFIED ELECTROSTATIC FIELD.

The focusing properties	Value
Focusing order	2
Center angle of focusing	30.7°
Xfoc coordinate of the focal point	5.04
Yfoc coordinate of the focal point	0.42
Reflection parameter, P	1

The relative energy resolution of the device at half maximum of the instrumental function is 0.85% at luminosity  $\Omega/2\pi=10.45\%$ .



**The instrumental function of energy analyzer for a point source case**

The proposed plane-symmetrical electron-optical system allows analyzing the distribution of charged particles in the energy with high resolution. The scheme provides a regime of second-order angular focusing of particle beams with a central angle of  $30^\circ$ .